Ex:

For the shown figure it's required to:

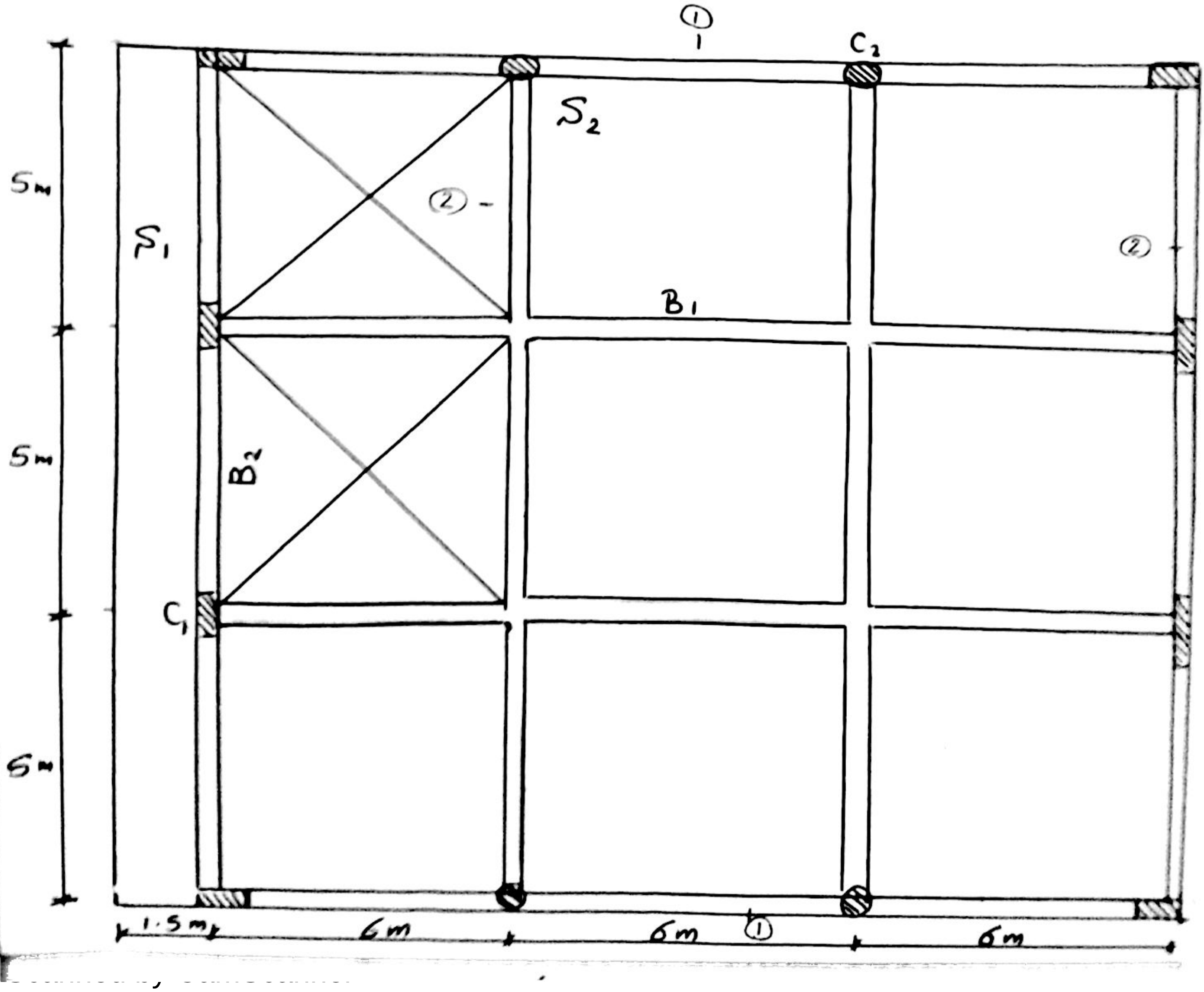
1- Design and give Complete reinforcement details for slabs S_1 & S_2. (Scale 1:100)

2- Design B_1 for flexure, shear & Torsion if any.

3- Design B_2 for flexure, shear & Torsion if any.

4- Calculate the Load of Column C_1 & C_2.

5- Design C_1 & C_2



* Given Data:

- $f_{cu} = 25$ MPa (N/mm^2) , $f_y = 360$ MPa
- F.C [flooring cover] = 2 kN/m^2
- L.L = 3 kN/m^2
- Parpet (سور) 120 * 200 mm , $\gamma_w = 16\ kN/m^3$ (كتله فارغة)
- B_1 (250 * 500) & B_2 (250 * 700)

$\boxed{1}$

1- Slab Condition

$S_1 \rightarrow \frac{L_{long}}{L_{short}} = \frac{6}{1.5} > 2$ [Cantiliver] one way slab.

$S_2 \rightarrow \frac{L_{long}}{L_{short}} = \frac{6}{5} = 1.2 < 2$ [two way slab].

2- Dim.

For $S_1 \rightarrow$ $t_s = \frac{L_s}{10} = \frac{1.5}{10} = 0.15\ m = 150\ mm$

For $S_2 \rightarrow$ $t_s = \frac{L_s}{40} = \frac{5}{40} = 0.125\ m = 125\ mm$

or

$$t_s = \frac{2(L_{long} + L_{short})}{180} = \frac{2(5+6)}{180} = 0.122\ m = 122\ mm$$

$\boxed{\text{Take : } t_s = 150\ mm}$

3- Loads:

* $D.L = o.w + F.C \rightarrow$
  * $o.w = \gamma_c \cdot t_s * 1 * 1 = 25 * 0.15 * 1 * 1 = 3.75\ kN/m^2$
  * $F.C$ = given ($2\ kN/m^2$)

$\therefore D.L = 3.75 + 2 = 5.75\ kN/m^2$

$L.L = 3\ KN/m^2$ (given)

$\therefore L.L\ (3\ KN/m^2) < 0.75\ D.L\ (0.75 * 5.75 = 4.3125\ KN/m^2)$

$\therefore W_{u_s} = 1.5\ (D.L + L.L) = 1.5\ (5.75 + 3) = 13.125\ KN/m^2$

For S_1 → one way : $W_{u_s} = 13.125\ KN/m^2 \qquad \alpha = 1$

For S_2 → two way :

$$r = \frac{m_L\ L_L}{m_s\ L_s} = \frac{0.87 * 6}{0.87 * 5} = 1.2$$

" Solid slab " عادية واعتبار الحمل أقل من $5\ KN/m^2$ فى حالة

$$\therefore \alpha = 0.5\,r - 0.15 = 0.5 * 1.2 - 0.15 = 0.45$$

$$\therefore \beta = \frac{0.35}{r} = 0.243$$

" Panelled Beams " فى حالة

$$\alpha = \frac{L_L^4}{L_L^4 + L_s^4} = 0.67$$

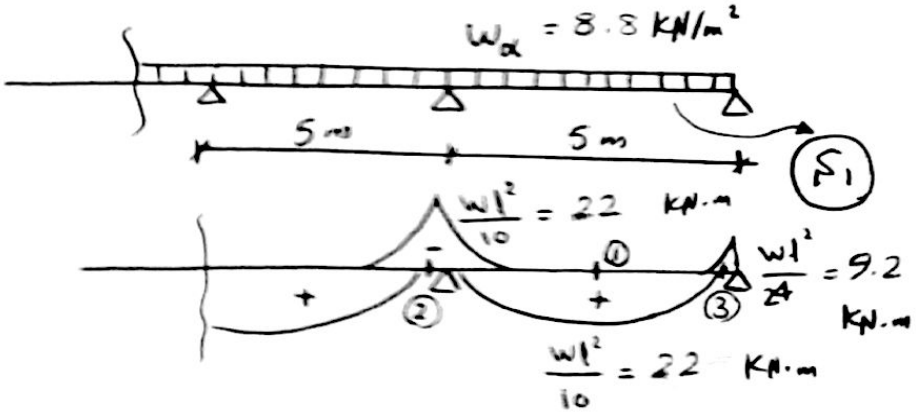
$$\beta = \frac{L_s^4}{L_L^4 + L_s^4} = 0.33$$

① $\therefore W_\alpha = W_{u_s} \cdot \alpha = 13.125 * 0.67 = 8.8\ KN/m^2$

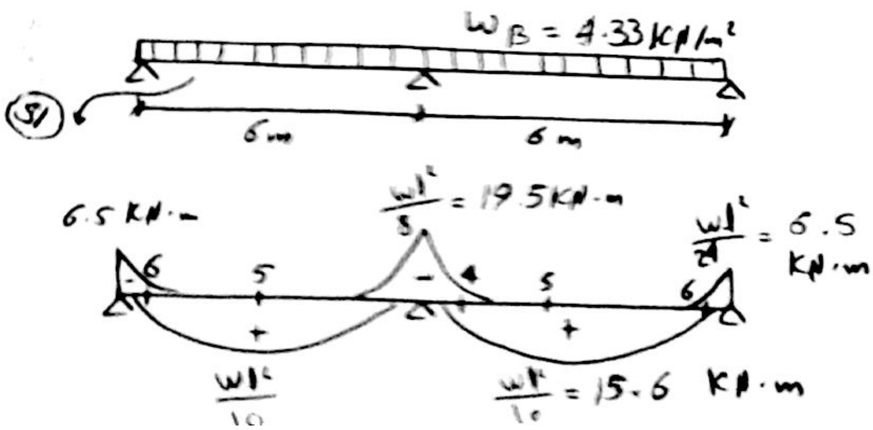
$\therefore W_\beta = W_{u_s} \cdot \beta = 13.125 * 0.33 = 4.33\ KN/m^2$

4- Strip & Moment :

strip 1-1 :

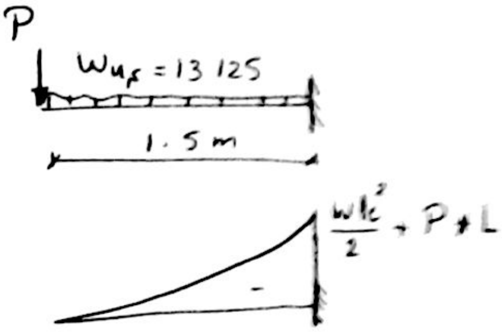


strip 2-2



Scanned by CamScanner

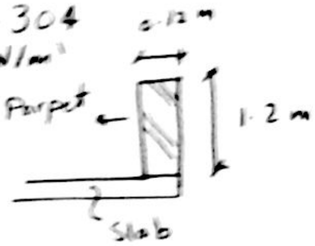
strip 3-3

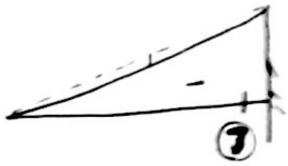


$$\underset{\text{وزن السور}}{P} = \gamma_w \cdot b_w \cdot h_w * 1 = 16 * 0.12 * 1.2 = 2.304 \ KN/m'$$

γ_w — عرض السور — ارتفاع السور

given كلام





$$\frac{13.125 * 1.5^2}{2} + 2.304 * 1.5$$

$$= 18.22 \ KN.m$$

---

4 - Design:

Cover = 20 mm

Sec 1-1 $\Rightarrow M_u = 14.75 \ KN.m \Rightarrow d = t_s - d' = 150 - 20 = 130$ mm

$$R = \frac{M_u}{b \cdot d^2} = \frac{22 * 10^6}{\underset{1m}{1000} * (130)^2} = 1.3$$

$\Rightarrow$ From Chart : $\mu = 0.45\%$

$$\therefore A_s = \frac{\mu}{100} * b * d = \frac{0.45}{100} * 1000 * 130 = 585 \ mm^2$$

For $\phi 10 \Rightarrow A_\phi = 78.5 \ mm^2$

$\therefore$ use $8 \phi 10/m'$

Sec 2-2

$M_u = M_u$ for Sec 1-1 use $\Rightarrow 8 \phi 10/m'$ for all.

Sec 3-3

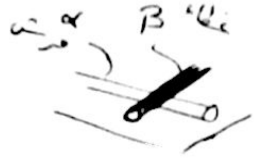
$$M_u = 9.2 \text{ kN}\cdot\text{m}$$

$$R = \frac{M_u}{b \cdot d^2} = \frac{9.2 * 10^6}{1000 * (130)^2} = 0.544$$

$$\therefore \mu = 0.2 \%$$

$$\therefore A_s = \frac{\mu}{100} b d = \frac{0.2}{100} * 1000 * 130 = 260 \text{ mm}^2$$

use : 5 ϕ 10/m' (min.)



قطر السيخ و اتجاه α

Sec 4-4

$$M_u = 19.5 \text{ kN}\cdot\text{m} \qquad d = t_s - \underbrace{d'}_{\text{cover}} - \phi = 150 - 20 - 10 = 120 \text{ mm}$$

$$R = \frac{M_u}{b \cdot d^2} = \frac{19.5 * 10^6}{1000 * (120)^2} = 1.35$$

$$\therefore \mu = 0.45 \%$$

$$A_s = \frac{\mu}{100} b d = \frac{0.45}{100} * 1000 * 120 = 540 \text{ mm}^2$$

Use : 7 ϕ 10/m'

Sec 5-5 : $M_u = 15.6 \text{ m}\cdot\text{kN}$

$$R = \frac{M_u}{b \cdot d^2} = \frac{15.6 * 10^6}{1000 * (120)^2} = 1.083$$

$$\mu = 0.37 \%$$

$$A_s = \frac{\mu}{100} b d = \frac{0.37}{100} * 1000 * 120 = 444 \text{ mm}^2$$

Use : 6 ϕ 10/m'

Sec 7-7

$M_u = 18.22\ KN.m$

$$R = \frac{M_u}{b \cdot d^2} = \frac{18.22 * 10^6}{1000 * (130)^2} = 1.08$$

From Chart $\Rightarrow \mu = 0.37$

$$\therefore A_s = \frac{\mu}{100} * b \cdot d = \frac{0.37}{100} * 1000 * 130 = 481\ mm^2$$

For $\phi 10 \longrightarrow A_s = 78.5\ mm^2$

$\therefore$ Use : $7\ \phi 10/m'$

Sec 6-6

$M_u = 6.5\ KN.m$

$$R = \frac{M_u}{b \cdot d^2} = \frac{6.5 * 10^6}{1000 * (120)^2} = 0.45$$

$\therefore \mu = 0.15$

$$\therefore A_s = \frac{\mu}{100} b d = \frac{0.15}{100} * 1000 * 120 = 180\ mm^2$$

Use : $5\ \phi 10/m'$ (min.)

* Scale 1 - 100 ⇒ 1Cm على الرسم = 1m
* Scale 1 - 50 ⇒ 2Cm على الرسم = 1m

NOTE

5 - Details: